Assignment 1

AI1110: Probability and Random Variables
Indian Institute of Techonology Hyderabad

K S Ananth
CS22BTECH11029

12.13.6.13: Question. Assume that the chances of a patient having a heart attack is 40%. It is also assumed that a meditation and yoga course reduce the risk of heart attack by 30% and prescription of certain drug reduces its chances by 25%. At a time a patient can choose any one of the two options with equal probabilities. It is given that after going through one of the two options the patient selected at random suffers a heart attack. Find the probability that the patient followed a course of meditation and yoga?
Answer: $\frac{14}{29}$.

Solution: According to the given question: the chances of heart attack is 40%.
Let:

A: Person with heart attack

E_1: Person who is treated with meditation and yoga

E_2: Person who is treated with drug

$$Given,\ P(A) = 40\% = 0.40$$

Also, the probabilities of meditation and yoga and drug is equal so.

$$P(E_1) = \frac{1}{2}, P(E_2) = \frac{1}{2}$$

In this question we have to find the probability of a person getting a heart attack and is followed with meditation and yoga. i.e. $P(E_1|A)$

$$P(E_1|A) = \frac{P(E_1).P(A|E_1)}{P(E_1).P(A|E_1) + P(E_2).P(A|E_2)}$$

Now we have to find $P(A|E_1)$ and $P(A|E_2)$.

$P(A|E_1)$ = Probability that a person getting a heart attack after being treated with meditation and yoga.

Meditation and yoga reduces the risk of a heart attack by 30%. There is still a 70% chance of heart attack.

$$P(A|E_1) = 0.40\,X\,0.70 = 0.28$$

$P(A|E_2)$ = Probability that a person getting a heart attack after being treated with drug.

Drug reduces the risk of a heart attack by 25%. There is still a 75% chance of heart attack.

$$P(A|E_2) = 0.40\,X\,0.75 = 0.30$$

$$P(E_1|A) = \frac{P(E_1).P(A|E_1)}{P(E_1).P(A|E_1) + P(E_2).P(A|E_2)}$$

$$= \frac{\frac{1}{2}X0.28}{\frac{1}{2}X0.28 + \frac{1}{2}X0.30}$$
$$= \frac{0.28}{0.28 + 0.30}$$
$$= \frac{0.28}{0.58}$$
$$= \frac{14}{29}$$